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LUBRICATION

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NATIONAL LUBRICATING GREASE INSTITUTE

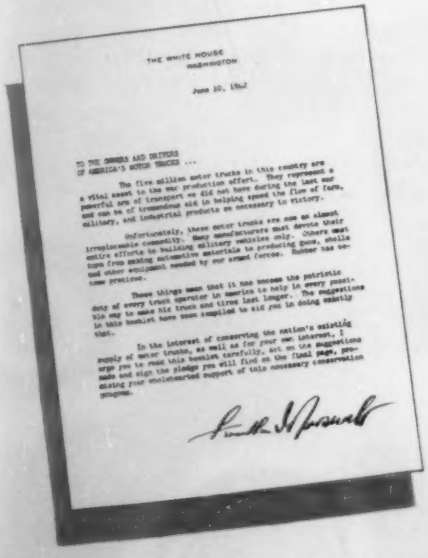
VOLUME VI • NUMBER 5 AUGUST, 1942

Biggest Truck Maintenance Program in History Launched Through Nation

Office of Defense Transportation Sponsors U. S. Truck Conservation Corps to Preserve Vital Vehicles and Parts

Endorsed by the President of the United States and sponsored by the Office of Defense Transportation, the greatest automotive lubrication and maintenance program in the Nation's history has been inaugurated to conserve trucks, tires, parts and critical materials, and to wrest from every existing commercial vehicle the last full mile of performance.

The need is desperate and the objective of the campaign of the utmost importance in our war effort. In the words of President Roosevelt, "trucks . . . represent a powerful arm of transport, and can be of tremendous aid in helping to speed the flow of farm, military and industrial products so necessary to victory."



THE WHITE HOUSE
WASHINGTON

June 10, 1942

TO THE OWNERS AND DRIVERS
OF AMERICA'S MOTOR TRUCKS ...

The five million motor trucks in this country are a vital asset to the war production effort. They represent a powerful arm of transport we did not have during the last war and can be of tremendous aid in helping speed the flow of farm, military, and industrial products so necessary to victory.

Unfortunately, these motor trucks are now an almost irreplaceable commodity. Many manufacturers that devote their entire efforts to building military vehicles only. Others must turn from making automotive materials to producing guns, shells and other equipment needed by our armed forces. Rubber has become precious.

Those things mean that it now becomes the patriotic duty of every truck operator in America to help in every possible way to make his truck and tires last longer. The suggestions in this booklet have been compiled to aid you in doing exactly that.

In the interest of conserving the nation's existing supply of motor trucks, as well as for your own interest, I urge you to read this booklet carefully, act on the suggestions made and sign the pledge you will find on the final page, proclaiming your wholehearted support of this necessary conservation program.

Franklin D. Roosevelt

A Powerful Campaign

"Every American should realize," says the foreword in a booklet by ODT, "that serious failure of our transportation system may not only cost the lives ordinarily lost in highway accidents, but may cost the lives of whole companies of men at the front because they were not supplied with the implements of war necessary to protect themselves. A breakdown of the transportation system of any country at war may easily cost that country the war. Ours must not break down."

With a full sense of its importance, ODT officials are placing behind this program the full force of a mighty campaign in which every avenue of promotion will be utilized. Oil companies will feature it in their advertising, newspaper and magazine editors in their articles and editorials, radio stations in their broadcasts. From thousands of service stations and garage windows throughout the Nation special posters will urge enlistment in the U. S. TRUCK CONSERVATION CORPS.

Millions of trucks will carry the emblem of membership. A special movie will spread the movement. Military organizations, governors, highway vehicle commissions, traffic clubs, mayors, chambers of commerce, automotive associations, teamsters' unions, service clubs—in fact, public officials and every organized unit possible—will be asked to cooperate in this gigantic movement to save America's trucks and aid in the war effort.

Booklet Mailed to Millions

The "opening gun" of the campaign is the mailing of a 16-page booklet, America's Trucks . . . Keep 'Em Rolling," to a list of nearly 3,000,000, including 2,550,000 truck owners, 220,000 service stations, 70,000 garages, 10,000 truck dealers, 10,000 tire dealers and 10,000 battery dealers.

(Continued on Page 4, Col. 1)

America's Trucks - Keep 'em Rolling

NATIONAL LUBRICATING GREASE INST. NLGI

Conical Cup for A.S.T.M. Penetration Test

THE MILLING OF LUBRICATION GREASES

PART II

By C. L. KNOPF

(Continued from July Issue)

The A.S.T.M. tentative method of test for consistency of lubricating greases, (D217-38T), Paragraph 3, states, "Tests for the unworked consistency of a lubricating grease shall be made only on a sample in the original container (or on a slab in the case of very hard greases). Cans having a capacity of 1 pound, approximately 8 cm. in diameter, are the best containers for this purpose."

FIG. 1

In a previous paper it was shown that cone penetrations of soft fibrous greases in 8 cm. containers may be more than 100% in error, and that accuracy is very materially improved by the employment of 7" cans. Since the A.S.T.M. does not make the 8 cm. container mandatory, tests of greases in original containers, such as 1-quart cans, 5-pound and 10-pound pails, will not be comparable with the penetrations in the 8 cm. can. Neither are worked consistency penetrations in the 3" mixer cup comparable with those in a 1-pound original container.

Besides the confusion caused by the variation in the original containers, the top layer of the grease, (which is the portion penetrated), may be far from representative of the sample in the center of the can; being lighter in consistency if oil separation has taken place and heavier if the surface has suffered oxidation, or evaporation, as in the case of cup greases. The suggestion that "rancid grease shall be discarded" from the surface, is not sufficiently definite. The most representative sample, naturally, is that selected from the center of the can, or at least 2" below the top surface. This requirement necessitates the transfer of the center sample to a standard test cup, the proposed conical cup being the most desirable for reasons outlined previously.

There has always been much misgiving in regard to such transferences; however, with reasonable care air pockets can be eliminated and the grease only very slightly worked in such a single transfer.

If the same care is always practiced, all samples should receive the same treatment so that the grease may still be considered in its original condition. The consistency of such a sample is representative of the consistency of the grease as the purchaser sees it; as the grease pump must handle it; or in the condition the grease is in when packed in a ball bearing, etc.

In light of the above, it appears impractical to use consistency values based on 60-stroke samples for writing specifications on grease, or for the purpose of controlling their manufacture. There is no legitimate reason why 60 strokes should be selected in preference to 30, 200 or 700 strokes. There are several very good reasons, however, why the consistencies of the original grease and of the 5,000 or 10,000-stroked sample should be known; the original consistency being that of the grease as it is put into service, (as discussed above); and the 5,000 or 10,000-stroke consistency indicative, of the grease while in service in an anti-friction bearing, for example.

The original consistency, therefore, classifies the grease with regard to its consistency only, just as the viscosity of an oil indicates its grade, and the size of a shoe its length. The life of these three commodities is another matter. In the case of grease, its life or stability against mechanical working is quite accurately indicated by the stability ratio, which is the final consistency divided by the original consistency. As this test is intended to show break-down due to mechanical working only, it is important that the worker cup be kept below 100°F., with fan, if necessary. Stability under high temperatures or against oxidation are different tests entirely and will be discussed later.

FIG. 2

Naturally the A.S.T.M. worker cannot be operated manually for 5,000 strokes; hence we give herewith details covering our machine; which during the past ten years, has been invaluable in the study of grease stability and other research problems.

Fig. 1 is a photograph of the Sinclair-Knopf Motorized Worker. A ⅓ H.P. (1200 RPM) induction motor, drives the 20:1 reduction gear, which operates the cross-head at 60 strokes per minute through a double pitman. The set-back revolution counter records the number of strokes.

The packing nuts on the cup cover, (Fig. 1 and Fig. 2), seal the rods so that grease will not extrude during the down-stroke of the perforated plate and also prevent the entrance of air during the up-stroke. The errors caused by aeration of grease were discussed before.

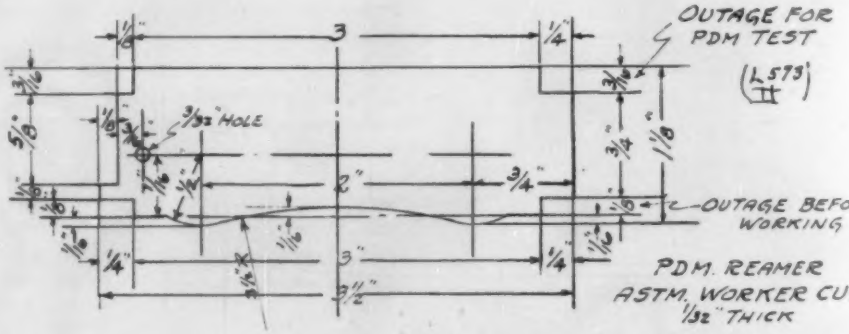


FIG. 3

(Continued on Page 3, Col. 1)

The INSTITUTE SPOKESMAN

Published monthly by
THE NATIONAL LUBRICATING GREASE INSTITUTE

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498 Winspear Avenue, Buffalo, N. Y.

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A.S.T.M. PENETRATION TEST

(*Continued from Page 2*)

The stainless steel plate reamer of special design is shown in the foreground and in Fig. 3. The curved part of the reamer is of such shape and dimensions so as to eliminate all air from the cup when the cap is screwed tight on the cup; the holes having been previously filled flush with the plate when the latter is tight against the cover (top stroke). The excess sample in the middle forces the air out of the open riser tube. The flexible metal reamer shown in the photograph removes excess grease from the riser, which is then sealed by means of the air-tight screw cap. Without the riser and with efficient stuffing boxes, the down-stroke pressure to operate the completely filled cup would be many times the normal force only to pass the grease through the perforations. The regular A.S.T.M. worker cup is made with considerable clearance for the rods, but such provision entails loss of sample and promotes aeration.

The riser provides an outlet for the grease displaced by the rods on the down stroke. The 2-cc. plug of grease re-enters the cup on the up-stroke, being impelled by the air pressure in the riser and by suction occasioned by withdrawal of the rods. The riser also insures against high pressure within the cup due to expansion of grease with increase in temperature.

Working drawings are herewith submitted; (*), if not clear we will be pleased to furnish additional information. The regular plunger plate has 59 holes of ¼" diameter, but a plate with 171 holes ⅛" in diameter (Fig. 2) has been used for semi-fluid products, the working time being cut to less than one-tenth.

Fig. 4 is a plot of four heavy soda-base greases showing how consistency decreases with mechanical working in the motorized worker. Consistencies are plotted on the uniform ordinate scale and A.S.T.M. double strokes as abscissa on the 5-cycle log scale, the transfer of the original sample

(*Continued on Page 6, Col. 1*)

*(working drawings furnished on request.)

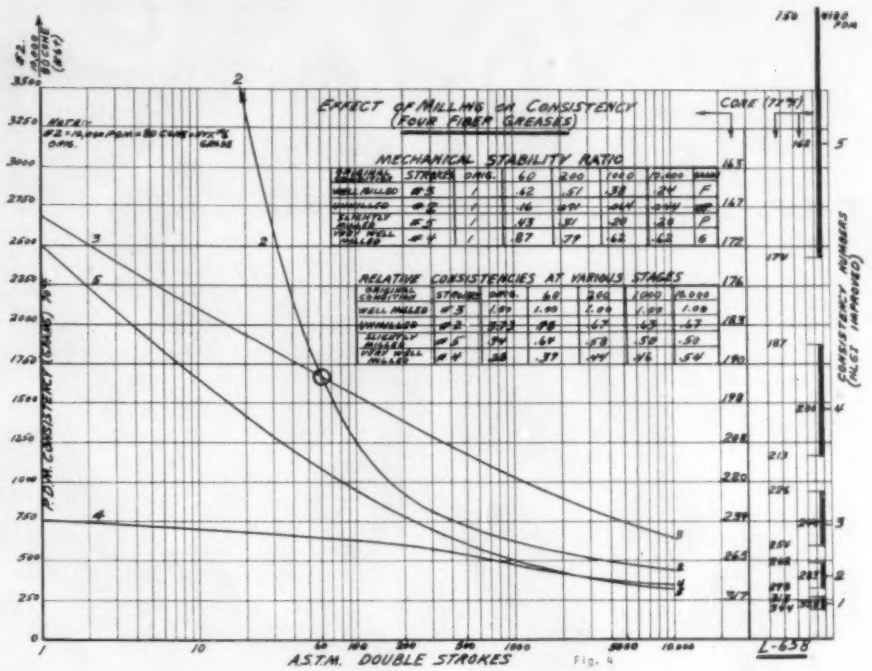


Fig. 4

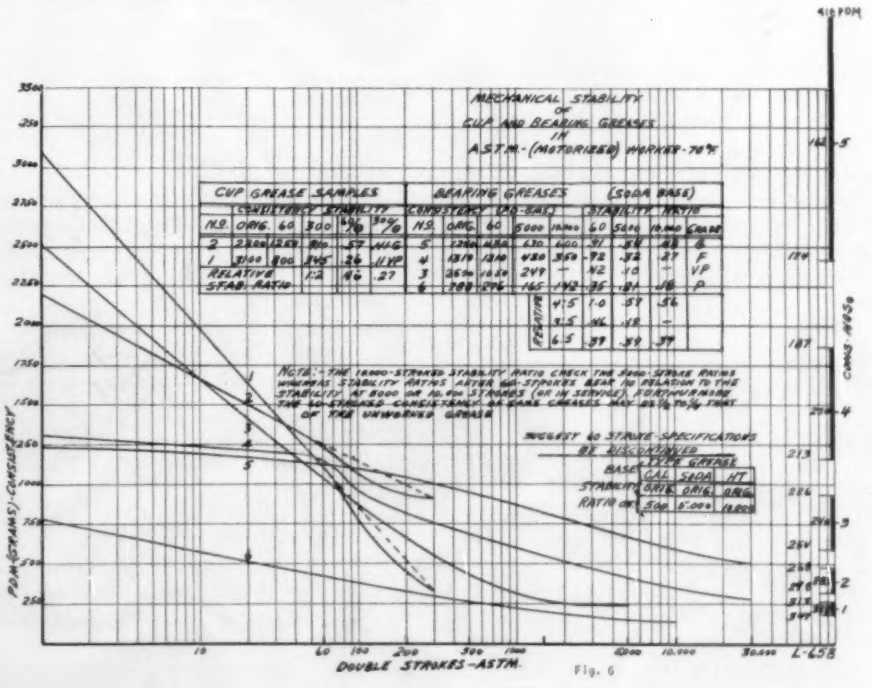

MECHANICAL STABILITY OF CUP AND BEARING GREASES IN A.S.T.M.-(MOTORIZED) WORKER-75°F.
CUP GREASE SAMPLES
BEARING GREASES (SODA BASE)
DOUBLE STROKES-ASTM.
L-658

Fig. 6

Truck Maintenance Program

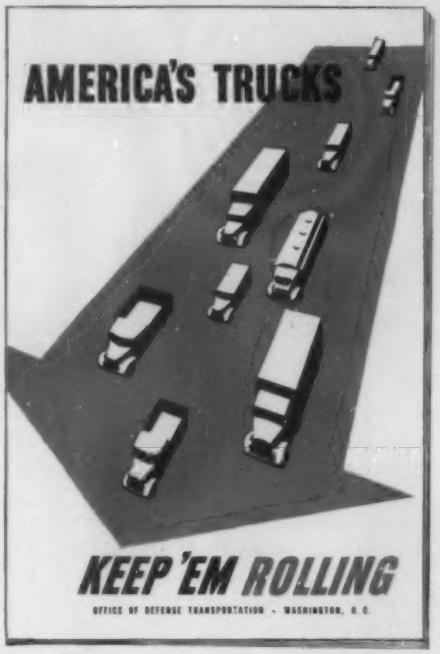
(*Continued from Page 1*)

This authoritative and practical booklet, which might be termed the "manual of arms" of the Corps, forms the foundation of the entire program. It is a practical and convincing presentation of the need for conservation and the best means of meeting that need. It includes a letter from President Roosevelt, a message from Joseph B. Eastman, Director of the Office of Defense Transportation, and an outline of the responsibilities of those who own, operate and service truck equipment. A "chamber of horror" section shows by actual photographs and records the ruinous damage to expensive and critical parts that results from lack of proper lubrication and maintenance. And then, as a means of avoiding such damage in these serious times, the booklet presents sound, simple and easily-followed suggestions on lubrication and maintenance, including putting the vehicle in good condition, daily check-up during operation and complete, correct lubrication and maintenance at specified mileage intervals.

OFFICIAL INSIGNIA PROVIDED

The official insignia of the Corps is a red, white and blue decalcomania, 5 x 9 in. reading "PLEDGED, U. S. TRUCK CONSERVATION CORPS." It will be awarded to those truck operators and owners who sign a pledge of sincere cooperation to conserve their equipment to the utmost. The insignia will be pasted on the right hand door of each pledged operator's truck.

Oil companies and service stations, truck manufacturers and their dealers, garages, parts distributors and other cooperative agencies become members when they pledge to "regard it as a patriotic duty to do all in their power to prolong the life of trucks, parts, tires or accessories entrusted to their care." For those who sign the pledge there is a special poster identifying them as an "OFFICIAL STATION, U. S. TRUCK CONSERVATION CORPS."



PLAN OF OPERATION

Oil companies and truck, tire, parts and accessory manufacturers will first enlist their own distributors and dealers as "Official Stations." Their own employees will first pledge themselves to conserve the Nation's commercial automotive equipment, parts and critical materials.

These "Official Stations," in turn, will sign up truck fleet owners their maintenance employees and individual truck operators. For each vehicle operated by a pledged owner, the "Official Station" will supply the official insignia decalcomania for mounting on the truck's door as an emblem of membership in the U. S. TRUCK CONSERVATION CORPS and of cooperation in our Nation's most gigantic Conservation Maintenance effort.

All insignia, posters, booklets and information are furnished by the ODT. Posters, pledges and general material will be supplied free. Insignia decals for pasting on trucks are available at $31.50 per thousand (minimum 1000) and additional copies of the booklet "America's Trucks . . . Keep 'Em Rolling!" may be obtained at the following prices: Less than 100, $0.05 each; 100 to 1000, $3.75 per 100; 1000 to 5000, $20.00 per 1000; and 5000 and up, $15.00 per 1000.

FOR FURTHER INFORMATION

All inquiries for further information or material should be addressed to: Mr. John L. Rogers, Div. of Motor Transportation, 4211 Interstate Commerce, Commission Bldg., Washington, D. C.

With thousands of service outlets—and MILLIONS of truck operators—pledged to the task of obtaining the "last long mile" out of every truck, truck-tractor, trailer and other piece of transportation equipment, and the program carefully and faithfully followed, all America will rightfully be able to lay claim to having performed a service secondary only to actual war combat.

DO YOUR PART
CONSERVE AMERICA'S TRUCKS . .
KEEP 'EM ROLLING . . LONGER!

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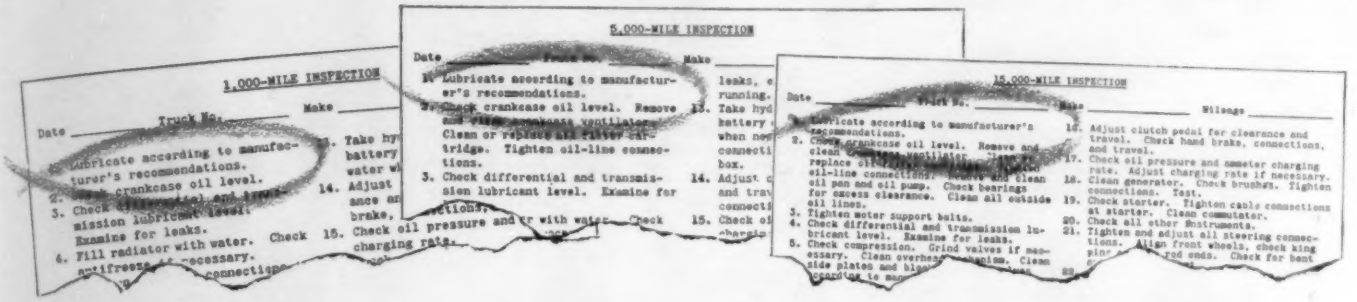
Manufacturers of

LUBRICATING GREASES

Lubrication -FIRST STEP IN TRUCK CONSERVATION



It is of utmost significance that the very first step in the U. S. TRUCK CONSERVATION CORPS campaign is lubrication.

In the ODT booklet, "America's Trucks . . . Keep 'Em Rolling," is a suggested plan of lubrication and maintenance based on servicing the vehicle every 1,000 miles, with special additional services at 5,000 and 15,000 mile interval. The first point in these vital conservation maintenance services is "LUBRICATE ACCORDING TO MANUFACTURER'S RECOMMENDATION."

Since lubrication is the foundation of Conservation Maintenance Service—the greatest single means of increasing life and decreasing the need for replacement parts and the use of critical materials—correct lubrication is the key factor in the success of the entire campaign.

Failure to lubricate properly just one point can cause sufficient damage to throw a truck out of service—to cause costly repairs—to consume valuable manpower for correcting the condition—or, perhaps, to require parts or critical materials more drastically needed in keeping our actual combat equipment in operation.

Examples of conditions caused by the lack of correct lubrication, reprinted from the ODT booklet referred to above, show why it is important that every possible means be taken by oil companies, service outlets, fleet maintenance departments and all others concerned with truck operation to conserve equipment, first of all, through correct factory-approved lubrication.

INDIVIDUAL DEALER HAS BIG PART IN TRUCK CONSERVATION PROGRAM

Every service station operator in America can be a "key man" in the U. S. TRUCK CONSERVATION CORPS—if he will enlist his efforts and facilities in the greatest automotive service task he ever has been called upon to perform.

And while he is rendering a truly patriotic service through the conservation of trucks, tires, parts and critical materials, the service station operator has an opportunity to bolster his service income and profits.

That the Truck Conservation Program sponsored by the Office of Defense Transportation holds promise of a gigantic volume of extra service business for service station operators is indicated in a statement made by Director Joseph B. Eastman of the ODT.

He says: "For every large fleet of a hundred or more trucks, there are thousands of individually owned trucks. This means that millions of men are either truck owners or drivers. Each and every one has an important part to play in conserving the nation's existing supply of motor trucks to the day of victory."

Since individual owners and operators, as a rule, do not maintain their own lubrication and maintenance facilities, this means that a tremendously large percentage must be lubricated and otherwise maintained by service stations and garages where adequate facilities are available.

With five million trucks registered, the U. S. TRUCK CONSERVATION CORPS program will stimulate business for dealers who prominently identify themselves with the movement and prepare to render the kind of service that really prolongs the life of trucks and reduces the need for parts and critical materials.

This means the right lubricant in the right place at the right time.

In order to qualify as a specialist capable of properly rendering truck lubrication service, you must have complete facilities (space and equipment), trained service men, a complete stock of lubricants, and—of utmost importance—a guide to assure correct application of lubricants in accordance with the Manufacturer's recommendations.

The matter of adequate facilities is one of major consideration in the placing of truck lubrication and maintenance business with service stations. Where space and equipment are available, the dealer has the opportunity to put forth an "all-out" victory effort; and if his service men are well qualified with a knowledge of lubricants and their application, that dealer is most likely to benefit from the U. S. TRUCK CONSERVATION CORPS program.

So, Mr. Dealer, it is up to you to do your part in this vital conservation program —your "mostest and bestest" are required to assure success.

Check your equipment-put it in tip-top shape—be sure you have the required lubricants—see that every service man knows the fundamentals of lubrication—and that your station is adequately supplied with CHEK-CHART Lubrication Guides that will assure correct lubrication of every truck or passenger car that you are called upon to service.

Sign the pledge today—make your station "Official Headquarters" for the U. S. TRUCK CONSERVATION CORPS and for TRUCK CONSERVATION MAINTENANCE SERVICE—to help KEEP AMERICA'S TRUCKS ROLLING—ON TO VICTORY!

A. S. T. M. Penetration Test

(Continued from Page 3)

to the worker cup being considered equivalent to one double stroke. This by definition is regarded as an original or unworked sample as discussed above.

The P.D.M. consistency is determined by the Consadometer, using a 1.3" head plunger moving at a uniform velocity of 9" per minute and the sample contained in the improved worker cup. Previously we showed that consistency is that property of a grease which resists deformation or change of shape; or the force required to move a disc-head plunger through a grease is a direct measurement of its consistency. The Consadometer P.D.M. measures this resisting force, or consistency, in grams; hence, break-downs may be expressed in exact ratio which is not possible with A.S.T.M. penetrations or similar arbitrary values. A previous paper, describing the advantages of the Conical Cup Method, also included chart L-671, which gives a correlation between P.D. (grams) consistency and penetrations with both steel and aluminum cones. P.D. M. grams x 1.1 = P. D. grams, consistency. By these means, cone readings after various amounts of break-down may be expressed in either P.D. or P.D.M. grams and stability ratios computed.

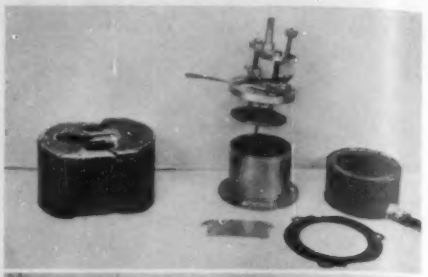
10,000 strokes as well as the final consistencies relative to No. 3 taken as unity. It can be shown that the four greases have approximately the same stability ratios at 5,000 as at 10,000 so that break-down time may be reduced from 2¾ hours to less than 1½ hours; however, for research work even 3 hours is not excessive time to devote to an important problem requiring accuracy.

Note the exceptional stability of Sample No. 4, which was homogenized and cold milled. The homogenization insures perfect saponification subsequent to removal from the kettle at 150°F. The P.D. Consadometer consistency of this grease was found to be uniform in a 25 pound pail, as well as constant, over a period of a month (within ± 0.3%).

Fig. 6 is similar to Figure 4 except the latter shows the effect of working cup greases and bearing greases. Much detail is given in the chart so that little discussion is necessary here. Note that the stability ratios for the 5,000-stroke check quite closely the 10,000 samples, but as mentioned before 10,000 strokes (2¾ hours) is really not a long time when the value of the tests is fully appreciated.

It appears that 300 strokes for cup greases seem quite sufficient, but 500 strokes might be more valuable. The right hand

FIG. 7 *(Below)*



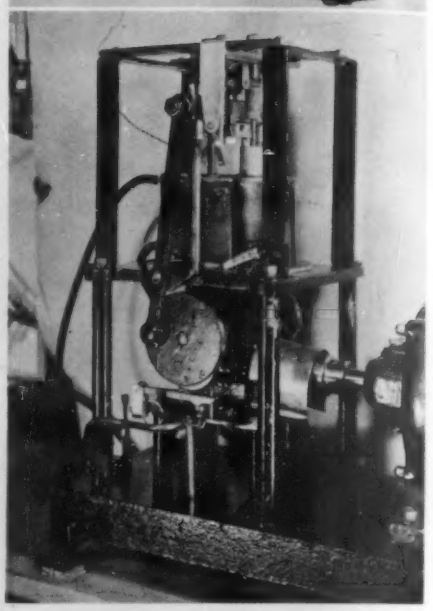


FIG. 8 *(Above)*

receives the thermocouple, permitting temperatures to be read in the center of the cup. A thermocouple is also in the side wall. The heater and clamp ring are shown at right, while insulating cover appears at the left.

Fig. 8 is a photograph of the motorized worker arranged for oxidation tests at high temperatures.

Fig. 9 is a schematic drawing of the apparatus as a suggestion for those who might wish to follow along the general idea of this test. The legend should be sufficient to describe each part and its purpose. It is usual practice to test hot-worked samples the day following the working, thus permitting samples to cool off and to set up over night. The overnight build-up of most greases, worked at room temperature, is not great so that samples may be run the same day as working; however, for standardization a 12 or 18 hour build-up period might be advisable before testing for consistency.

The consistencies under different treatment are as follows:

Sample No.	Original Condition	P.D.M. Consistency at			Stability	
		Original (1st)	60 Strokes	10,000 Strokes	Ratio final:orig.	Rating
2	Unmilled	10,000	1,650	450	.044	V. V. Poor
3	Well Milled	2,690	1,660	650	.24	Fair
5	Slightly Milled	2,500	1,080	340	.13	Poor
4	Homogenized and Milled	750	650	360	.48	Good

In Fig. 4 samples No. 2, No. 3 and No. 5 are heavy, soda-cylinder-stock greases, while No. 4 is a similar, but lighter product, a wheel bearing grease.

Note that No. 2 originally is about four times as heavy as No. 3 and No. 5, which condemns it for use in ball bearings, while the two latter products are very satisfactory. Note that No. 2 and No. 3 are the same after 60 strokes, implying indentical consistencies based on 60-strokes specifications.

Also note that No. 3 and No. 5 are nearly the same in original consistency and are equally suitable for a particular service; however, at 10,000 strokes the consistency of No. 3 is just twice as great as for No. 5, indicating No. 3 to be the more stable.

Fig. 4 contains two tables which give valuable data relative to this subject. The mechanical stability rations are given at column of the table gives tentative grades, G = good, F = fair, etc., which compare with ratios of .48, .27, etc. The relative stability ratios for 5,000 and 10,000 check much closer than the actual ratios.

Fig. 7 is a photograph of the hot worker-cup used in oxidizing greases at various temperatures, the purpose being to classify greases with regard to their stability against oxidation. This test may be run under a wide range of service conditions in which the temperature can be held constant at any temperature up to 400°F., the working may be done without aeration or with different rates of air flowing through the cup.

A copper-tube loop, silver soldered to the screw cap, heats the air before entering the cup at the left. The cup is vented through the poppet valve at the right. The copper tube in the center of the perforated plate

CONCLUSIONS:

Consistency measurements should be much more accurate and informative if the improvements in equipment and methods

(Continued on Page 7, Col. 1)

A. S. T. M. Penetration Test

(Continued from Page 6)

are followed as outlined in this and the paper on the Conical Cup. The stuffing boxes and riser on the A.S.T.M. cup eliminate aeration; the special reamer insures exclusion of air from the worker cup. The 60-stroke specification should be discontinued, and the original consistency employed in specifications instead, as this is the consistency of the grease as it is sold and put into service. The stability ratio (5,000 or 10,000-stroke sample divided by the consistency of the original) gives valuable data relative to the stability of a grease. Specifications should also include the stability ratio.

Homogenization of soda-greases insures perfect saponification and uniformity of product. It assures the industry of quality greases that undergo a minimum amount of "build-up" in service.

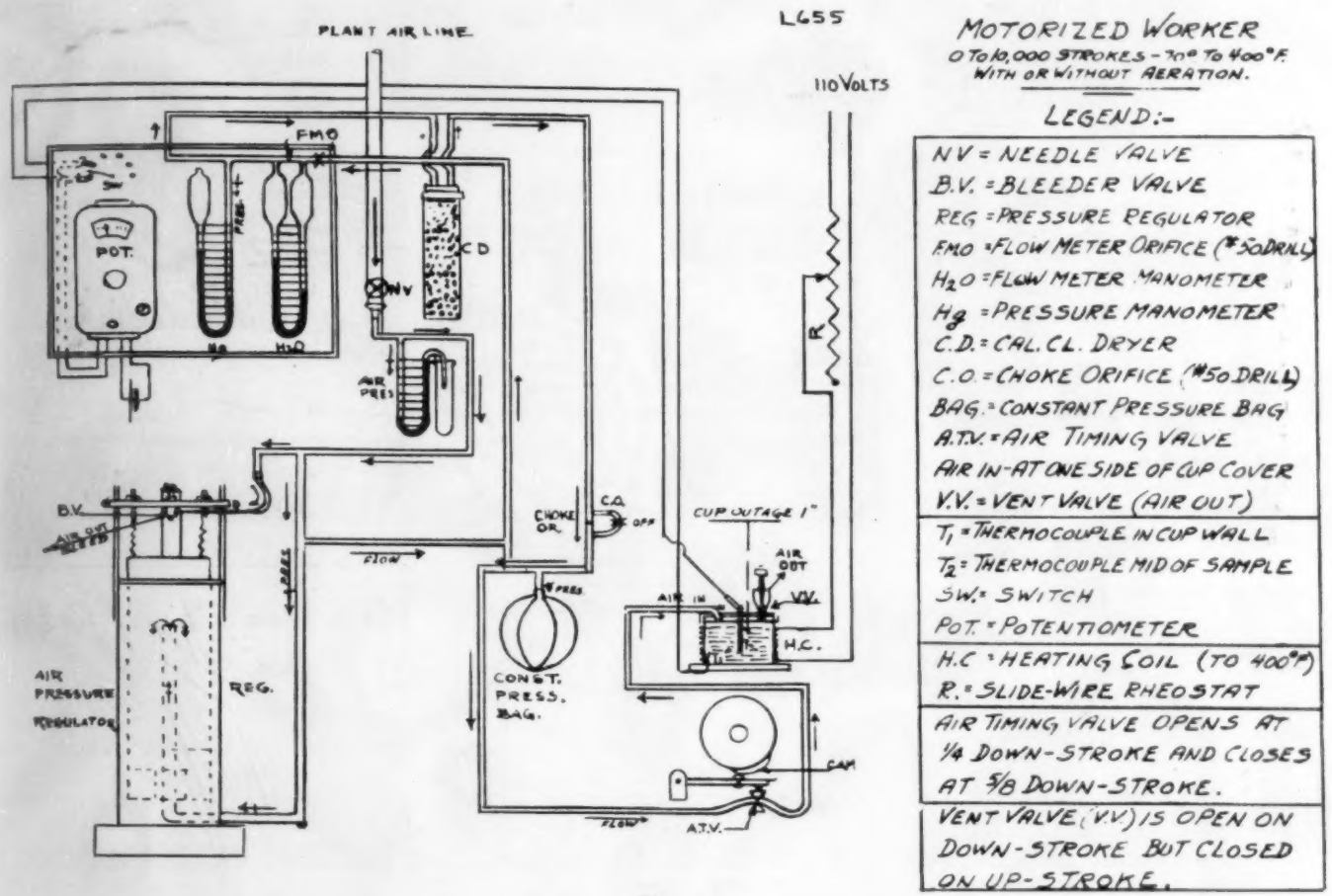


Fig. 9

WOOL GREASES
(Degras)
Common — Neutral — Lanolin
For All Purposes
Refined by
N. I. MALMSTROM & CO.
BROOKLYN, N. Y.

ALL GRADES OF GRAPHITE
FOR THE GREASE & OIL COMPOUNDER
EXCELLENCE D SINCE 1827
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